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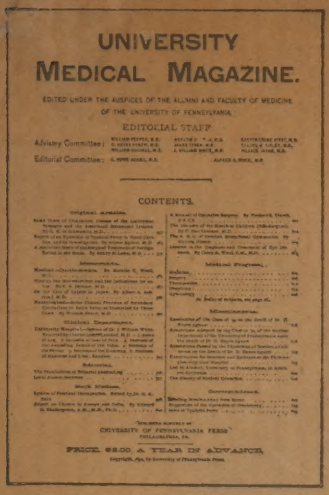

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Billings (J. S.)

MUNICIPAL MORTALITY STATISTICS.

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Municipal mortality statistics have a very considerable scientific interest and value, independent of their utility as a foundation for municipal hygiene. They are, as a rule, more complete and accurate than the mortality statistics of rural and thinly-settled districts, or of States and nations taken as a whole, and furnish some of the best data which we possess for studying certain problems connected with sociology and political economy, as well as those relating to the causes of particular forms of disease.

By mortality statistics we mean the ratios of deaths occurring in any given group of population during one year, or for one year of life of that group, except in the case of very young infants, and we express these rates as being so much per 1000 or per 100,000 of population. $M = \frac{D}{P}$. To obtain the most useful and valuable results from the study of death-rates, these must be properly comparable with each other. The factors which influence death-rates may be conveniently divided into two classes,—general and local. The most important general factors are the proportions of the different ages, sexes, and races in the population in which the deaths occurred; the local factors include what are generally called sanitary conditions, the incidence of epidemics, etc., and before we can properly estimate the nature and force of these local influences by comparisons of data from different localities, or from the same locality at different times, it is necessary to eliminate, as far as possible, differences due solely to variations in the general factors,—to secure a common denominator, as it were. Take,

for example, the factor of age. As will be seen by Table I, the death-rate of children under five years of age is from seven to nine times as great as that of persons from fifteen to forty-five years of age, while after forty-five the death-rate is again much higher. The death-rate in any community or group of persons depends therefore very much upon the proportion of young children and of old persons in the population of that community or group. This influence of age is especially marked in the death-rates of certain diseases, as diphtheria, which is especially a disease of children, or of apoplexy or heart-disease, which pertain chiefly to persons over forty-five.

In like manner the influence of race, while not so great as that of age, is very considerable, even on the general death-rate, as will be seen from the figures given for the white and colored in Table I, and for different races of whites in Table II. It is not my purpose at this time to discuss the results of such comparisons, and they are alluded to merely to indicate their probable importance and interest.

The difficulties in the way of obtaining the data for making such comparisons are great, and it is to some of these difficulties that attention is now called. To calculate a death-rate, we must know the number of deaths for a given period of time—say a year—and the average number of people for that year among whom these deaths occurred. If we wish to know the death-rate from consumption among whites from fifteen to forty-five years of age, we must know the number of deaths from this cause in this class, and the number of the class itself. It is much easier to obtain such information with regard to the number of deaths than it is with regard to the population, but if the classification is a minute one, it is usually impossible to obtain the data for either the deaths or for the population.

The form for the registration of a death used in our cities usually calls for information with regard to the age, sex, color, birthplace, and occupation of the deceased person, and for a statement of the date, place, and cause of the death, and whether the person was married, single, widowed, or divorced. In those cities which have the best form of registration, information is also asked as to the birthplace of the father and of the mother of the deceased person. This is specially important information for American cities at the present time, as it is the only way in which we can get a clue to the probable race, since the birthplace of the person does not afford such a clue, especially for persons under twenty-five years of age. Philadelphia, Baltimore, Chicago, St. Louis, New Orleans, Louisville, Allegheny, and many other of our principal cities (ten out of the twenty-eight over 100,000), do not require this item, and hence very little information as to the relations of race to different causes of death is to be obtained from the records of

these cities. Even when the registration forms contain all the information we ask for, the results of their compilation are usually published in municipal reports in such a way as not to permit of their use in scientific discussions with regard to the different causes of death. Such published statistics, for example, will show the number of deaths due to each of certain causes of death in persons in each of certain age groups. They will also, perhaps, show the number of deaths from each cause in the white and colored, in the native and foreign born, in each month of the year, and the number of deaths of persons following each of a number of different occupations. They will not, however, show the number of deaths due to a certain disease, as, for example, consumption, in persons of Irish descent in each age group, nor will they show the number of deaths caused by consumption among carpenters, masons, shoemakers, etc., between the ages of twenty-five and forty-five. When, however, such data are urgently wanted, the materials for compiling them may be in existence in the registration office in the form of the original returns for registration of death, and it is thus possible, at considerable expense and trouble, to obtain the information classified in the way one desires for the purpose of a particular research.

This, however, is not true as regards the population, which is always a matter of much greater uncertainty than the deaths, when one comes to deal with special limited groups for the purpose of preparing death-rates. As a rule, the population in our cities is obtained only once in ten years, with the distinctions of sex, age, color, birthplace, birthplaces of parents, conjugal condition, occupation, etc.,—that is, by the United States Census. In a few of the States, there is an intermediate census calling for the same data, so that in the cities in these States there is really a count of the population every five years. Except for a period of time in which the date of the census occurs in the middle of it, the population of a given city, or part of a city or of a particular group of population in the city, can only be a matter of estimate derived from certain mathematical calculations, into the details of which it is not necessary here to enter. No police census, school census, or any other form of census undertaken by a city ever enumerates the population with the distinctions of age, sex, color, etc., which are necessary for the calculation of special death-rates; and even as regards the gross population, such municipal censuses are very rarely sufficiently accurate to be relied upon in the calculation of death-rates, while for many of the subdivisions of population which are desirable for the calculation of special death-rates, the cities of the United States cannot obtain even approximate data for calculation from the published results of the United States or of the State Censuses

The United States Census will give for each city of over 25,000 inhabitants the number of its population, with distinctions of age, sex, color, native and foreign born, and of parentage, but for only a few cities will the distinction of birthplace of mother be given.

When we attempt to use the mortality statistics of cities for the investigation of the effects of local influences upon death-rates, and especially upon death-rates due to certain special forms of disease, we meet with still greater difficulties. In the first place, it is desirable to study the death-rates of a city not only as a whole, but also for certain parts of the city which present peculiarities, the effects of which we desire to ascertain. If, for example, we desire to study the effects of density of population, or soil drainage, of poverty, or of sewerage upon death-rates, it is necessary to compare different parts of the same city from these points of view. As a rule, however, the subdivision of a city into wards or into police districts has no relation to the altitude, soil dampness, density or character of population, or to the character of the dwellings, of the several districts, and hence, the information derivable from ward death-rates, even if we could obtain them, is by no means definite and satisfactory as to the influence of the various circumstances upon mortality.

For scientific purposes, as well as for the purposes of practical hygiene, it is very desirable that the mortality statistics of a city should be compiled with reference to units of area, selected with regard to circumstances which may have an influence on the life of the inhabitants, and not solely for political considerations. In the Eleventh Census an attempt was made to do something in this direction, by establishing divisions in a few cities—namely, Boston, New York, Brooklyn, Philadelphia, Baltimore, and Washington—with reference to the points above referred to. For example, in New York, which is divided into twenty-four wards, 114 sanitary districts, as they were called, were thus created. The records of deaths in the city were copied for each individual, each death being credited to the sanitary district in which it occurred, as far as possible. Many of the deaths which occurred in hospitals, asylums, and other institutions could not properly be credited to the district in which such institutions were located, and, as far as possible, information was obtained as to the district from which the person dying in an institution had been sent to that place, and the death was then credited to that district, as being the locality in which the original disease or injury had occurred. The census data with regard to population were then compiled for each of these districts, with distinctions of age, sex, birthplaces of mothers, etc., and thus were obtained the factors necessary to calculate death-rates for each sanitary district. The results are in many respects

of great value, both locally and from a scientific point of view, but, as stated above, it is not my purpose to discuss them here. Those who are interested in them will find them in the reports published by the census office.

I wish next to call attention to a special difficulty which presents itself when we attempt to use death-rates derived from the comparatively small number of people in a sanitary district for purposes of comparison and investigation into the influences which affect special causes of death. The smaller the factors used in calculating such ratios as death-rates, the greater, as is well known, is the amount of what is commonly called "probable error" in these ratios, by which is meant not so much the probable error as the possible error which may occur from the much greater influence which a comparatively small variation in a few of the individual data will have upon the results when the numbers concerned are small than when they are large. If we divide the population of a sanitary district into the various classes of sex, age, race, etc., which have been suggested as desirable, it may very well happen that in a district we shall find that there was one Frenchman between the age of 45 and 65 living in the district, as shown by the census, and that the death record shows that one Frenchman between the age of 45 and 65 died in that district during the preceding year, which would give, say, a mortality of 100 per cent. In the same district there may be two Hungarians of the same age group, and no deaths of Hungarians in that age group occurred during the year. This may be considered as an extreme instance, but it is one which has actually occurred several times, and it may readily be seen that we cannot properly draw the conclusion from such figures that the mortality of Frenchmen of this age in that district is 100 times greater than that of Hungarians of the same age. It has even occurred in the census figures that in a certain very small group of population, the number who died during the year was three or four times as great as the number left living at the end of the year, indicating a mortality of over 100 per cent. Special care must, therefore, be taken in studying statistics of this kind to take into consideration the magnitude of the figures forming the factors for each special death-rate, as well as the magnitude of the death-rate itself. It should be noted, however, that the probable or possible error connected with the magnitude of the number of years of life, which is used as the divisor to obtain the ratio which we call the death-rate, differs very considerably according to the manner in which those years of life have been reckoned. Fifty persons living for ten years, and 500 persons living for one year each give 500 years of life, but the average annual death-rate obtained for the first group, by dividing the number of

deaths which occurred in it during ten years by 500, will be more nearly a correct one than the one obtained for the group of 500, by using it as a divisor for the number of deaths which occurred in it during one year. If we can obtain the average death-rates of even a small sanitary district for a period of twenty years, the possible error due to the smallness of the numbers will, to a great extent, disappear, and they will be much more reliable as a measure of the tendency to death in that district than will be the death-rates of the whole city, of which it is a part, if taken for a single year.

The difficulties which a statistical officer of a city meets in attempting to prepare special rates of the kind referred to for different parts of the city have heretofore been so great in cities of this country as to be practically insurmountable. If his death records were properly kept and well looked after, it may be possible for him to classify the deaths by such sanitary districts as he may select, and by such further subdivisions of sex, age, etc., as he may think it desirable to use, but by no possibility could he obtain corresponding data for the population of these districts. For some cities the published records of the Tenth Census gave the gross population by wards. The Eleventh Census, as has been said, gives the population of a few cities by sanitary districts, but the characteristics of sanitary districts in a growing city are apt to change, and hence the health officer may desire to establish other boundaries than those which have been used for the census. But even supposing that a municipal statistician is satisfied to make use of the local subdivisions into sanitary districts employed by the census, he has no means at present of calculating the amount of change which has taken place in the several groups of population of a sanitary district since June 1, 1890, if, for example, he wishes to make his calculations for the year 1894. The means ordinarily made use of to calculate the population of a district or of a city at a period two or three years distant from the last census is the well-known geometrical progression formula, based on the ratios of increase or decrease of the population of the district or of the city which has been found to occur within the given time, by a comparison of the results of the last two censuses of the place. In the case of these sanitary districts, however, such a ratio cannot be accurately computed, because at present the results of but one census are available, and we can only apply the general ratio which may be computed for the whole city to one of its sanitary districts, and errors may thus be introduced, because while the population of the city may, as a whole, be increasing considerably, the population in some districts in the business and crowded portion of the city may be actually decreasing, while a much greater than the average rate of increase is taking place in some of the more thinly-settled districts at the periphery, owing to increase in means of rapid transportation.

The only means, therefore, of obtaining accurate data with regard to the population of such sanitary districts for intermediate periods would be for the city to undertake to make a special census of them, or of some of them, for the use of the statistician or health officer of the place, but at present it is tolerably safe to say that there is no city in this country which would be willing to spend the money which would be necessary to accomplish this. It will, therefore, be necessary to wait until the next United States Census, in the hope that it will obtain the populations of these sanitary districts with the same classification and grouping as were used in the Eleventh Census, in order to afford data for the preparation of ratios for intermediate or for future years.

It is impossible to publish in full, the data as to population or deaths which would be required for such a minute study of the mortality statistics of a large city as has been herein indicated as desirable. Let us suppose, for example, that a city is divided into twenty sanitary districts, and that in each of these districts the population is to be classified into twenty age groups of each of the two sexes of each of ten races. This would give a table showing 8000 places of figures, which would fill at least ten pages such as are contained in the quarto volumes of the census. If to this be added further subdivisions as to the conjugal condition and of the occupation of those 15 years of age and upwards, allowing four divisions for the conjugal condition and a classification of 100 occupations, we should have a further series which would occupy at least 400,000 places of figures. To tabulate the deaths in like manner, giving the particulars for each of 100 different causes of death in addition for each of the subdivisions, would require about 40,000,000 places of figures. Such subdivisions, or anything approaching them, are, of course, absolutely impossible, and would be useless. It is necessary to make a careful selection of those combinations of the different factors which seem most likely to have an influence upon the death-rates, and then as far as possible to induce the statisticians of the different cities to compile and publish their mortality statistics in conformity with such classification.

In order to avoid the fallacies due to the use of small numbers, the medical statistician desires, in studying the relations of a certain disease to conditions of sex, age, race, occupation, etc., to combine the data furnished by the records of a considerable number of cities; but in attempting to do this he meets with great difficulties, because some of these data are either not obtained or not published in such a way as to be comparable. In some cities data as to race are not obtainable, even from the original records; in others, the items of occupation, conjugal condition, etc., are not required on the forms for registering a death,

and even if place is made for them on the form, no attention may be given by the person in charge of the registration to seeing that they are properly filled out. If we take the ten cities referred to on Table I and desire to obtain from their records the death-rates of those who may properly be termed Americans of the professional class from diseases of the nervous system, with distinctions of sex, age, and conjugal condition, in order to compare these with similar statistics of those of Irish or German descent, we shall find that in only two or three of the cities are the necessary details complete enough for this purpose.

The State of Pennsylvania has no general system of registration of deaths, being in this respect the most backward of all the older Northern States. It contains a large number of cities, very few of which have complete registration records, and many of which have none.

In Philadelphia, Allentown, Altoona, Carlisle, Erie, Harrisburg, McKeesport, Reading, Scranton, Williamsport, and York the birthplaces of parents are not called for on the registration form. In Allentown, Harrisburg, and Carlisle no record is made of the birthplace of the decedent. In Carlisle neither conjugal condition nor occupation is recorded. In Philadelphia, Pittsburg, Allentown, Altoona, Erie, McKeesport, Norristown, Reading, Scranton, Titusville, Williamsport, and York the record of conjugal condition is for married or single only, no note being made of divorced, most of whom are probably returned as single. On the certificates used in Bradford, Pennsylvania, in 1890, there is a place on the stub of the certificate, which is to be returned by the physician, for the item of color, but no record of color is made in the body of the certificate which he sends to the health office.

It would be easy to specify many divergencies of this kind, of greater or less importance, but I have said enough to indicate some of the difficulties which the statistician meets with at the present time in attempting to investigate mortality statistics in this country. It would require very little change in the form of certificate employed in our principal cities to enable it to furnish proper data, and thus afford the means of obtaining a uniform record of facts as a basis for scientific municipal mortality statistics.

TABLE I.

Municipal Death-Rates in 1890.

	White.	Colored.	Under 5.	15-45.	45 and Over.
New York	28.5	37.5	96.8	13.5	47.2
Chicago	21.0	23.3	69.9	8.9	30.9
Philadelphia	22.3	32.4	76.0	10.4	37.4
Brooklyn	25.4	35.0	86.0	11.3	41.5
St. Louis	18.2	34.6	56.9	9.2	32.4
Boston	24.6	33.3	87.2	12.2	40.9
Baltimore	22.6	36.4	93.0	10.0	37.6
Cincinnati	21.9	33.0	76.4	10.3	36.6
New Orleans	25.4	36.6	75.4	15.2	47.7
Washington, D. C.	19.8	38.2	97.8	12.0	34.1
Sum of twenty-eight cities	22.8	33.6	78.0	10.7	

TABLE II.

Municipal Death-Rates in 1890—Whites.

	Of Children of Mothers Born in				
	United States.	Ireland.	Germany.	France.	Italy.
New York	29.0	32.2	22.0	24.1	40.0
Brooklyn	26.0	27.8	21.6	14.9	30.8
Boston	21.0	28.4	18.6	17.6	24.8
Cincinnati	20.7	19.8	17.9	8.6	15.8
Washington	16.0	25.5	19.8	16.3	14.1
Sum of eighteen cities	20.9	26.7	19.9	19.0	33.4

CONSUMPTION.

Death-Rates per 100,000 of Population of Corresponding Ages having Mothers born in the Specified Countries.

Color and Birthplaces of Mothers.	15 to 45 Years.	45 to 65 Years.	65 Years and Over (Ex. Unknown).
White	398.11	432.49	438.24
Colored	676.51	684.40	658.02
Birthplaces of mothers.			
United States (white)	228.49	240.26	252.26
England and Wales	256.80	350.73	302.41
Ireland	630.45	651.09	753.07
Scotland	363.66	361.01	402.34
France	276.96	444.02	633.80
Germany	340.75	420.99	452.32
Canada	490.34	350.11	462.53
Scandinavia	406.06	497.22	597.01
Hungary	193.85	777.20	
Bohemia	730.47	680.79	
Italy	261.60	385.08	420.17
Other foreign countries	259.87	451.49	581.21

These figures are for the sum of Boston, Brooklyn, Cincinnati, New York City, the District of Columbia, and the State of New Jersey.